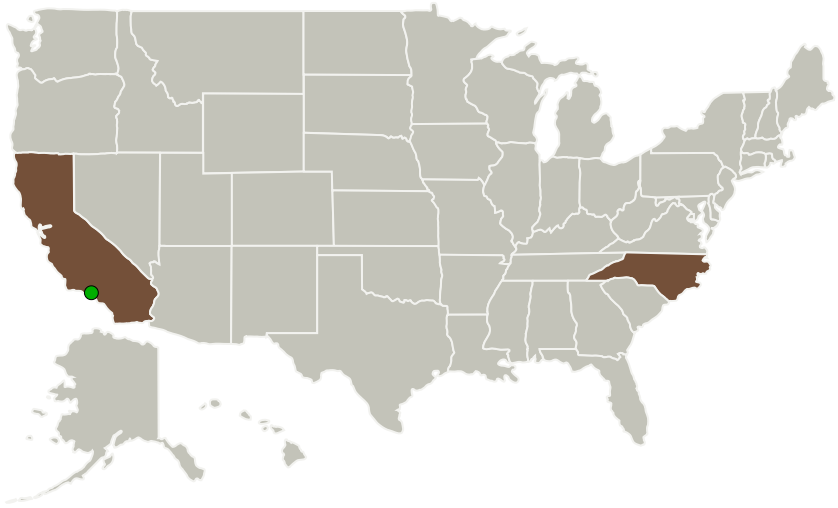
X-Band GaN Power Amplifiers for Long Range Space RF Telecommunications, Phase I

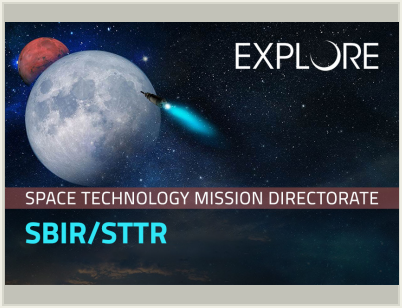
Completed Technology Project (2012 - 2012)

Project Introduction

The future capabilities of sensors and instrumentation deployed in space will continue to increase, resulting in increasing amounts of collected data. To reach these higher speed data rates, increases to the overall system gain of the communication link will be required. A deterministic method to increase system gain of a RF communication link is to provide higher transmitted RF power. However, with this higher RF output power also comes the challenge of maximizing power efficiency and reducing the size weight and power (SWAP) of the power amplifier (PA) for long-range space missions. The innovation will be to develop a Solid-State Power Amplifier (SSPA) that produces 50 W of linear RF at X-Band (8.4 GHz) with high DC-to-RF-efficiency (> 60%) and low mass. The significance will be the utilization of wide band-gap RF semiconductors to efficiently create high RF power that is robust to the high radiation environments of space. A wide band-gap compound semiconductor material such as Gallium Nitride (GaN) will provide this required innovation. GaN-based Field Effect Transistors (FETs) have the potential to operate at power densities of up to 10 times that of conventional RF semiconductor technologies, which will enable compact PAs with higher RF output power to be implemented. The proposed GaN PA design is estimated to be >50% smaller in both size and weight compared to other solid state solutions and almost 20% lower in power consumption for typical designs used in long-range space RF Telecommunications. In summary, Applying novel GaN semiconductor materials in innovative PA designs are required for long-range space RF communication systems to fully reach their performance potential and to reduce their SWAP.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Nitronex Corporation	Lead Organization	Industry	Durham, North Carolina
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	North Carolina

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140238)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nitronex Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

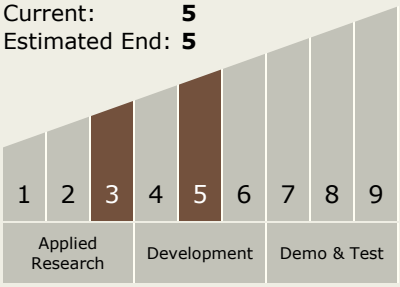
Carlos Torrez

Principal Investigator:

Alan Victor

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.2 Power-Efficiency

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System